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BLACK LOCUST PLANTING FOR EROSION CONTROL

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NORTHEASTERN FOREST EXPERIMENT STATION
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The value of forest cover on non-agricultural lands for erosion control has been definitely established, but in many regions a combination of improved agricultural practices, the establishment of gully-dams or other engineering works, and the planting of forest trees are all necessary to solve the erosion problem. Where erosion is not severe - or where it is confined largely to moderate sheet washing - terracing, contour plowing, cover crops, and other improved methods of agriculture may suffice for control. A sod cover is often effective and under favorable conditions may be used for pasture, if not overgrazed. In many instances, however, pasturing tends to reduce the effectiveness of grass cover, and to increase erosion.

On steep slopes or on very erosive soils a permanent cover of forest trees is often the most successful means of preventing excessive run-off of water and severe erosion. The soils of many localities have been so severely impoverished by past cultivation, leaching and washing, that only a forest cover may be established and maintained economically. Furthermore, a forest not only holds the soil in place very effectively by the binding action of tree roots and by the protective cover of leaf litter, but it also increases the porosity and water absorption capacity of the soil (1)*, improves its fertility, provides refuge for game, birds, and other wild life, and produces profitable forest crops, which, if harvested properly, may be removed periodically without sacrificing the protective value of the cover.

Where gullying is very severe, check dams also may be of benefit in erosion control. Their construction and use have been described in a number of publications, some of which (5) (7) (9) are referred to in Literature Cited, page 5, so that no attempt is made to cover this subject in this report.

Black locust is particularly well adapted for erosion planting. It establishes itself readily even on poor, dry sites such as are found on abandoned farm lands throughout the Central States. In such an environment locust may not be expected to make good growth, and it often succumbs at an early age to locust borer attack, but it holds the soil temporarily, thus providing an opportunity for other trees, plants or grasses to become established. Numerous suckers and sprouts appear wherever the rapidly spreading roots become cut or injured in any way, as by subsequent erosion, and add to the protective value of the cover. The investigations of Chapman (2), McIntyre and Jeffries (4) demonstrate the beneficial effect of black locust in improving the site and stimulating the growth of associated trees by the fixation of nitrogen.

*Numbers in parentheses refer to Literature Cited, page 5

Black locust seed is relatively cheap and readily obtainable in large quantities, although the present practice of depending largely upon foreign sources of seed is of doubtful wisdom (3). The seedlings grow very rapidly and may be planted out after a few months to a year in the seedbed. When nursery stock is not available, root sprouts or root cuttings may be used for emergency planting. Black locust grows very rapidly on the better soils, where injury from locust borers is generally lower, and soon produces valuable crops of fence posts or other products of great strength and durability. It seeds abundantly at an early age and reproduces prolifically.

The recommendations regarding the planting of black locust which follow are the result of numerous observations of the success or failure of many plantations established by different agencies under a variety of conditions, largely on a trial and error basis. Much necessary information is still lacking because of the piecemeal manner in which these observations were obtained. Many of the unsuccessful black locust plantings have disappeared so completely that the lessons to be learned from them have been entirely lost. A comprehensive and well-coordinated study of forest planting and plantations must be completed before many final conclusions can be drawn.

Spacing. The usual spacing recommended for black locust plantations is 6 feet by 6 feet, or 1,210 trees per acre. On steep, badly eroding slopes closer spacing with trees 3 or 4 feet apart may sometimes be desirable, to bind the soil in place as quickly as possible. On level land where washing is not severe, a wider spacing with trees 8 feet apart (680 per acre) is less costly and often results in satisfactory control of the erosion. The sprouting habit of locust, wherever the spreading roots are uncovered, bruised or torn, usually insures a full stand of trees on eroding land, even where comparatively wide spacing is used. Root suckers can be stimulated artificially in young plantings by breaking the roots with a plow or disc.

Regular spacing is generally inadvisable on the steep sides and rough bottoms of gullies. Advantage should be taken of the more sheltered and favorable spots where the trees are most likely to become established promptly and securely. Trees planted in gully bottoms directly behind check dams are in danger of being covered with the washed-in soil unless planting is delayed until the terrace is well established. For the same reason the rims and steeper slopes of the gullies should be plowed down or otherwise reduced before planting. It is advisable to replace trees which die, to secure a complete cover.

Mixture of Species. The many advantages of planting mixed stands of two or more tree species are well recognized. In mixed forests the dangers of loss from insects, disease, and other enemies are much reduced; soil and site conditions are improved; wood production is usually increased; the silvical and biological environment of the artificial forest becomes balanced and approaches that of the natural forest, a very desirable condition. For these reasons, the planting of other tree species with black locust is highly recommended, especially where wood products, other than those yielded by locust, are wanted. Moreover, on soils poorly adapted to the successful growth of black locust, or where excessive damage by the locust borer is practically a certainty, it is usually safer to plant some other species in mixture. On such sites the use of locust is recommended only because of the prompt establishment of this species and its soil-binding and soil-building values.

In the past there has been so little planting of locust in mixture with other species that there are few examples upon which to base recommendations. R. C. Hall has found that mixtures of locust with catalpa have not displayed a reduction of borer infestation as in mixtures with other hardwoods. Plantations of black locust with a volunteer understory of hard maple have been found to form a very excellent mixture, yielding high protective value and an excellent forest litter. A native mixture of locust, red maple, red oak, black cherry, and black oak has been found to develop a good litter and a good stand. Yellow poplar is often found mixed with locust in natural stands on good sites. Throughout the unglaciated, southern portions of the Central States, shortleaf, pitch, and Virginia pine are possibly adapted for planting on eroded lands with black locust. Present knowledge indicates that the pines should be given a start ahead of the locust, possibly 2-5 years. In this region few successful mixtures of locust with northern or exotic conifers have been found. Native hardwoods should be used only on the better and more fertile soils. Wherever hardwoods volunteer, they should be encouraged as a component of the stand.

Very little is known on the best methods of making mixed plantings. One method of mixing species is to plant alternate trees of the various kinds. Alternate rows of a single species, or planting groups of a single species may possibly succeed. The latter method may apply particularly where there are local variations of site favorable to a single species and unfavorable to others. Since locust is intolerant of shade, it will not thrive if it is subjected to serious overtopping or crowding by associated species.

Planting Methods. The best time for planting is early spring before growth starts, although fall planting is also resorted to, especially in the South. Seedlings planted in the fall may be subject to frost heaving during the following winter, especially in northern regions and on exposed slopes. Mattocks are commonly preferred for setting the trees, but heavy spades or dibbles may be used in light soils free from stones. Occasionally it is desirable to plow the area in order to prepare the site to the best advantage and to facilitate planting. Where it is unnecessary or undesirable to plow the entire area, planting in plowed furrows is recommended. It is essential to keep the roots moist at all times, and they should be evenly distributed and spread out in the planting hole. Cultivation of the tree rows is sometimes practiced for the first year or two, but such cultural methods are not generally necessary. Meginnes (8) considers cultivation of distinct advantage in increasing growth in height and leaf surface and in reducing damage by leaf miners. On severely eroded areas further disturbance of the soil or its vegetative cover by plowing or cultivation is often undesirable.

The plantation should be adequate in size to anchor the sides and head of the gully. This calls for the extension of the planting operations out around the wash for a width of at least 15 or 20 feet. Unless the margins of the gully are bound with the fibrous locust rootlets, it may continue to extend back into adjacent field or pasture land. Very often the entire field or surrounding areas in which the gully occurs is in danger of subsequent erosion and, therefore, unsuited for agricultural cultivation. In such instances the wisest and best land use is to grow a cover crop of trees.

Planting Stock - Nursery Seedlings. Most State forestry departments have established nurseries which produce tree seedlings for planting on State or other public lands; trees are also available, usually by purchase at a nominal price, for private planters. Some commercial tree nurseries produce forest planting stock. It is very unwise to ship in stock from a distance, because of the danger of importing and spreading some active disease on the stock. Since locust seedlings are easily grown in one year's time, the establishment of a home nursery is recommended for planters who can secure stock in no other way or who wish to raise their supply (6).

One-year-old seedlings, from 12 to 18 inches in height above the ground, are usually preferred for planting in the Central States, although larger stock is sometimes recommended for use in the South. Seedlings smaller than this usually lack the sturdiness essential for rapid establishment, and larger stock is both difficult to handle and costly to plant. Where climatic and soil conditions are favorable, seedlings sometimes grow several feet in height in the nursery in one year's time. To overcome such undesirable height growth, the planting of the seeds in the nursery beds is often delayed until late spring or early summer. In the Tennessee State Forest nursery, black locust seedlings are kept down to an 8 or 10-inch size for convenient handling by mowing off their tops in the seedbed with a tractor-drawn machine, and similarly the stock is root-pruned in the seedbed to eliminate excessively long root systems.

So far as size is concerned, good seedlings of one season's growth in the nursery are ready for either fall or spring planting. Seedlings or transplants over one year of age are usually too large for successful and economical planting in this region. When seedlings are too large, or where conditions of climate or site are unfavorable to their establishment after planting, it is usually advisable to cut back the stems to a point a few inches above the ground. This may be done as the seedlings are dug in the nursery, or just before or immediately after they are planted.

Other Sources of Planting Stock. When nursery seedlings are not available, stock suitable for emergency erosion planting may be secured from other sources. Many successful locust plantations for posts have been established by the use of small sprouts or root suckers dug locally around healthy, well-formed trees. If the roots from which the suckers are obtained are well provided with fibrous rootlets, they can be dug and immediately replanted, preferably in the early spring. Lacking these rootlets, the sprout should be prepared for removal a year in advance, by cutting the main root off a few inches from either side of the sprout. This treatment forces the development of the necessary rootlets.

Root cuttings from 6 to 10 inches long and from $\frac{1}{2}$ to 1 inch thick may also be used to establish black locust. Toumey (10) states that the cuttings should be made in the fall or winter and planted immediately or wrapped in moss and stored in a cool, moist cellar. The process of storing develops a callous at the cut ends and stimulates the production of buds. Ordinarily they should be held in the nursery for one year before being planted in the field. An experimental planting of fresh forest root cuttings in Illinois blow-sand by Dr. Hall of this Station developed vigorous sprouts, but the tops were killed back by the severe summer drouth of 1933.

Direct seeding of black locust for the control of gullies is not advisable. Without previous treatment, the seed is very slow to germinate, and raw soil conditions in eroded gullies are seldom favorable for vigorous, rapid growth of tiny seedlings. In addition, the likelihood of the seed's being washed away, buried deeply, or consumed by rodents and birds, makes direct seeding a hazardous and undesirable method of establishing black locust.

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Notes: "Total Paid" and "Total Received"